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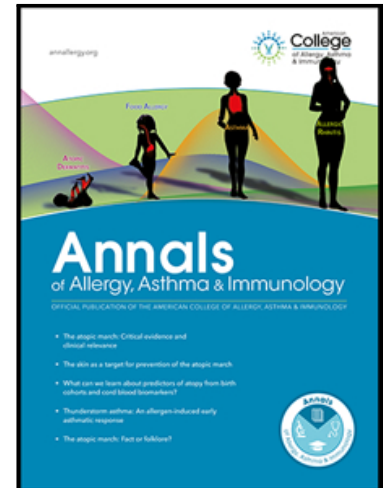
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PII: S1081-1206(22)00048-5
DOI: <https://doi.org/10.1016/j.anai.2022.01.027>
Reference: ANAI 3829



To appear in: *Annals of Allergy, Asthma Immunology*

Received date: 21 October 2021
Revised date: 10 January 2022
Accepted date: 14 January 2022

Please cite this article as: Sean Stout MD , Helen Murphy RRT , Aarti Pandya MD , Hung-Wen Yeh PhD , Jay Portnoy MD , The Effect of COVID-19 on Asthma Visits, *Annals of Allergy, Asthma Immunology* (2022), doi: <https://doi.org/10.1016/j.anai.2022.01.027>

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The Effect of COVID-19 on Asthma Visits

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Conflict of Interest statements:

Sean Stout has no relevant conflicts to disclose

Helen Murphy has no relevant conflicts to disclose

Aarti Pandya has no relevant conflicts to disclose

Hung-Wen Yeh has no relevant conflicts to disclose

Jay Portnoy has no relevant conflicts to disclose

Funding Source: none

Keywords:

Asthma, COVID-19, pediatrics, hospitalization, Emergency Department

Letter

Unscheduled Emergency Department (ED) and Inpatient (IP) visits for pediatric asthma have been shown to be decreased during COVID-19. However, each of these reports have had their limitations. Arsenault, et al compared asthma ED visits for 2020 with 2019 only. It is difficult to make an inference from this single-year comparison since 2019 could have been an abnormal year. (1) Kenyon, et al compared visits for the first 4 months of 2020 with those months from 4 previous years. This did not account for the overall reductions in all visits due to COVID. (2) Levene et al, also compared the first 4 months of 2020 with the previous year. As was the case with Arsenault's report, it is difficult to make inferences with a single year comparison. (3) Taquechel, et al compared the first 60 days of 2020, from January 17th to March 17th, to the second 60 days, from March 17th to May 17th, and with the same periods for the years 2015-2019. This publication did correct for total visits which is the only previously published paper to do so. (4) The report from Krivek, et al was a letter with very limited information about admissions (only examined a one-month period from March to April 2020, compared with the same period from the previous three years). (5) There was a comparison with other factors (ie: pollen, NO₂, PM₁₀ and respiratory tract infections) however the values were very limited. It is also unclear how their respiratory tract infection admissions were monitored (clinically diagnosed vs. PCR-proven). (5) A recent report by Guijon compared asthma visits 90 days pre- and post-school closure in 2020 with the same time periods in the years 2017-2019. (6) Other possible asthma triggers were examined, however these only included one particular type of air pollution (PM 2.5) and the analysis of respiratory viral illnesses was limited to influenza only, leaving out a multitude of other respiratory viruses that are known to trigger asthma. Since asthma visits tend to occur seasonally with peaks in the spring and fall months, any observed reduction could be due to a combination of factors in addition to COVID-19, including a reduction in viral infections, changes in allergen exposure and changes in exposure to air pollutants. (7)

The objective of this study was to determine the effect of COVID-19 on unscheduled asthma visits by comparing monthly 2020 visits with those from the previous 10 years (2010-2019). To do this, we queried the electronic medical records at a tertiary pediatric hospital to identify the total number of patients with asthma per month who were seen in an Emergency Department/urgent care clinic (ED), an inpatient unit (IP), or who visited an outpatient (OP) clinic between 2010 and 2020 for a primary diagnosis of asthma (ICD-9 of 493 or ICD-10 of J45). Total outpatient (OP) visits were used to control for the overall effect of COVID-19 on scheduled visits. Monthly pollen counts for 2010-19 were obtained from samples obtained with a Burkard sampler located on the roof of the hospital. Pollen counts for 2020 were obtained from an Allergenco sampler because the Burkard was not accessible during COVID.

Virus data were obtained from the Children's Mercy Hospital microbiology laboratory. This included all results from respiratory panel PCR testing done between 2010 and 2020. Monthly percent of positive virus isolates (rhinovirus, influenza and total virus) were also evaluated to determine their contribution to these visits. Air pollutants including ozone and PM 2.5 data were obtained from the Environmental Protection Agency website. Time series analysis via the integer-valued generalized autoregressive conditional heteroscedasticity (INGARCH) model for asthma visit counts and the autoregressive (ARIMA) model for percent of asthma visits were used to determine the significance of 2020 data vs the previous decade.

Total IP, ED and OP asthma visits were significantly reduced in 2020 vs the previous 10 years primarily in the spring and fall months but not during the summer or winter when visits were normally low (Figure 1 A). In addition, there was a decrease in percent asthma visits for the ED and IP relative to total ED and IP visits but an increased percent of OP spring visits (Figure 1 B and C) suggesting that unscheduled visits were reduced while scheduled OP visits were increased more than total visits to those same locations. These reductions were sustained when adjusted for air pollution and pollen counts, however, reduced percent of positive virus isolates correlated

with reduced asthma visits. When each environmental variable was evaluated in an ARIMA model, the only significant differences were a decrease in total virus in March 2020 and viral PCR percent positive testing during April through December, except for July. No other variables showed significant changes. When categorized by age, children under age 5 years had fewer visits for all the pandemic months, children 6-12 years had fewer visits except during June and July and older children did not experience significantly fewer asthma visits.

Until now it has not been possible to separate the contribution of respiratory infections towards unscheduled asthma visits from that of the other triggers. (8) COVID-19 has provided a unique opportunity by strongly reducing the contribution that respiratory infections have on exacerbations due to social distancing and widespread use of facial coverings. Other asthma triggers including exposure to indoor and outdoor allergens (9), air pollution, environmental tobacco smoke and changes in weather are unlikely to have been affected by interventions used to avoid COVID-19, which is supported by the lack of significant changes in these variables during the pandemic. For that reason, the reduction seen in asthma utilization seen during COVID-19 appears to be due to a reduction of respiratory infections. These findings support those found earlier by Taquechel et al, in which rhinovirus positive testing decreased during the pandemic and air pollution levels remained unchanged. (4) They do, however, partially contradict Guijon's report, that found air pollution to be significantly affected by the pandemic, suggesting the need for more research looking at this variable. Interestingly, the reduction in asthma visits at our facility was most pronounced in the youngest patients, and tapers as age increases, suggesting a more predominant role for viruses as a trigger for asthma in patients <5 years old.

In conclusion, unscheduled asthma visits were significantly reduced during COVID-19. This is most likely due to reduced viral URIs since other variables did not change during this same time.

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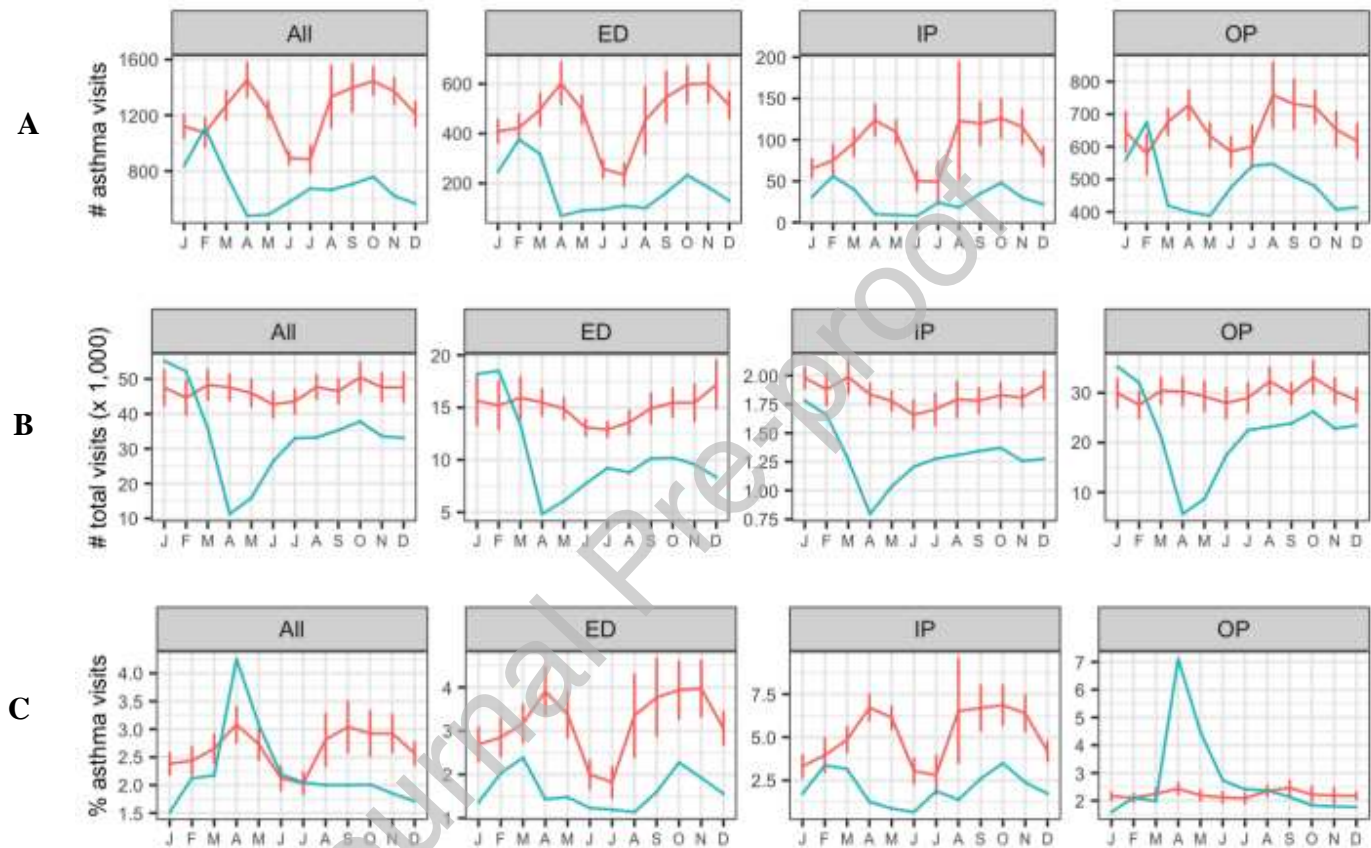


Figure 1. Unscheduled (ED and IP) and scheduled (OP) Asthma (row A) and total visits (row B) to Children's Mercy Hospital during 2020 (green lines) compared to mean (95% CI) scheduled and unscheduled asthma and total visits (row C) from 2010-2019 (red lines). ED=Emergency Department/Urgent Care, IP=Inpatient, OP=Outpatient, ALL=all visits.